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With the writer's compliments

METEOROLOGY AND ITS PROFESSORS

This Pamphlet is respectfully dedicated to all whom it may concern,

By their obedient servant,

THOS. D. KING.

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METEOROLOGY AND ITS PROFESSORS.

If a Professor of Meteorology is fitted to rank with those professors who attempt to discover the secret operations of nature, whether in the heavens or in the deepest problems of mechanics, or in the interior of the earth, or in the finely woven tissues of organic structure, and who are concerned for the discovery of new phenomena, or to draw the light of knowledge from the unexplored depths of nature, then—the study of Meteorology is as necessary as the study of chemistry, botany, physiology, astronomy and geology.

It is difficult to understand why the study of the air, weather and seasons, with the varied and interesting appearance which they present, has not received greater attention from educated persons, more particularly from those who are interested in agriculture and shipping. The fact of the existence of periodical variations in the temperature of the years and seasons in our own climate, of the terrific thunderstorms and hurricanes which frequently visit us in the summer, should incite us to a more constant and more diligent study of the phenomena, since we may thus become qualified to avail ourselves of a considerable degree of knowledge of these changes.

One of the reasons for the little notice given to Meteorology in Montreal—no more interest generally being taken in it than of the weather column of a shilling almanac—may arise from the fact that the Professor of Meteorology has not given to the pupils of McGill College popular lectures on a science as necessary as natural history, geology and astronomy, teaching them " the balancings of the clouds " mentioned in Holy Writ as a part of the wondrous works of HIM who is perfect in knowledge. It ought to be the duty of a professor of an university, which has conferred upon him honors and degrees, who undertakes the work of public instruction, to present to the students of his college in simple arrangement, and enable them to comprehend with ease—things, the natural history of which has cost Science a world of pains to analyze and recompose.

Of the causes which have induced the author of this communication to write, and also forced him to print this protest, little need be said. The task is a thankless one; it may make enemies; truth has always done so. The discerning of truth without difference of opinion is unattainable, and perhaps the disputes of the learned are necessary for the wants of science and its continual advancement, therefore he offers no apology. It is far from necessary to his present object to state all his reasons for the course he has taken, but it is absolutely expedient for him to assert that he is actuated by no envious or ignoble feeling, but solely from a desire to see science pursued with that true dignity which is its due, and that it may get more attention—particularly that branch of it called Meteorology—from the Faculty than it has hitherto received.

Some medical friends, believing that atmospheric changes have considerable influence on health, and that there is an immediate connexion between the peculiar state of the air and the kind of disorders which may thereby be excited, and further, thinking that Montreal might possibly be afflicted with some fatal epidemic, asked the writer to take, if possible, during the past summer, hourly observations of the temperature, humidity and barometric pressure of the atmosphere.

He willingly undertook the task for three reasons: *firstly*, in the interests of Meteorology; *secondly*, because he did not believe, in common with others familiar with the subject, in the exaggerated published statements about the temperature in Montreal, plus 96 and 100, and minus 38 and 43; *thirdly*, because he had for many years entertained doubts not only as to the general accuracy of the observations published by the Director of the so-called "Montreal Observatory" and Professor of Meteorology at McGill College, but he had reasons to believe that all the published observations were not taken at the Observatory in the McGill College grounds, and he knew that many of the instruments used were not in accordance, either in design or quality, with those employed at the Greenwich or Kew Observatories, and recognized by the Royal Society and British Association for the Advancement of Science.

In taking, for four months, almost hourly observations, between 7 a.m. and 9 p.m.—sometimes between 1 and 3 p.m. half-hourly notes as a check on the maximum temperature of the day—he was kindly assisted by a professional gentleman who was assiduously exact and pains-taking.

Monthly summaries of the observations have already appeared in the *Canada Medical and Surgical Journal* without dispute; others were circulated amongst those interested in them. Daily summaries, that could be easily understood by the non-scientific public, were published in two journals, but are now discontinued; in the one, on account of its decease; in the other, solely in consequence of some importunity which led the editor and proprietor to substitute others for them; whether interest or inclination formed the primary and ruling motive in the change the writer will not stop to enquire, he being neither impelled by ambition or necessity to furnish them freely for the public benefit. If the public derived useful information from them, and was satisfied with their accuracy, he is fully compensated, although they demanded unremitted devotion of time, which may readily be believed when upwards of sixty observations were taken every day, and these had not only to be registered and reduced and corrections applied to them to fit them for any scientific purpose, but they had to be prepared for daily publication.

The obligations of the task, from the nature and object of the observations, demanded more than usual care and the use of standard instruments (positively so); thermometers and hygrometers duly protected against their own radiation to the sky, and against the light reflected by neighbouring objects, such as limestone buildings, adjacent walls, and duly sheltered from rain and hail. Extra care was taken in the choice of instruments and in the mode and time of observing. A standard thermometer, divided on its own stem, supplied by the Kew Observatory was employed, the observed temperatures by it were checked by a very delicate and sensitive insulated centigrade thermometer, with an enamelled glass scale subdivided to fifths of a degree, by Schulze, of Berlin; the mate of which was used as a Wet Bulb thermometer in order to get the Relative Humidity to hundreths. Two pair of maxima and minima thermometers, by Pastorelli, were used; one of the maxima on Professor Phillips's plan; the other on a plan invented and patented by Negretti; both the minimas on Rutherford's plan. Great care had been taken in these to eliminate or destroy all sources of error. The object in using two pairs was a mutual check. One pair was tested by Professor Kingston, Director of the Magnetic Observatory, Toronto, and sole Director of the Meteorological Department so wisely instituted by the Hon. Peter Mitchell, Minister of Marine and Fisheries; the greatest error of the maximum thermometer being 0.2, and of the minimum thermometer, at low temperatures, 0.1, (the errors in both instruments being merely nominal).

The barometer used was a brass scaled one throughout its entire length, corrected for capacity, its maximum error between 29.00 and 30.50 being 0.01, and its minimum error 0.002 by comparison with the Greenwich standard.

The situation of the instruments, or the place where they were observed, had not its exact latitude or longitude determined, but assumed to be about—according to Bouchette's tables—4 hours, 54 min., 17 sec. West of Greenwich, and in latitude North 45°.31';

the height of the cistern of barometer, as near as possible, 88 feet above summer level of Montreal Harbour datum as determined by the City Surveyor; constant 0.100 always allowed for the reduction of the readings to sea level. Suffice it to say that the thermometers were placed in a court where there was a free current of air and within fifty yards of a similar court where many of the assumed doubtful observations were made, and within a quarter of a mile of the McGill College Observatory proper. The barometer used by the writer was placed in a room not liable to sudden variations of temperature, and as near the Director's barometer or barometers as the out-door thermometers respectively used by them; so near, that he is puzzled to account for the difference between some of their recorded barometrical readings, unless the atmospheric pressure at the same minute, at two places, within so small an area, is liable, ordinarily, to depress or raise the mercurial column 0.05 or 0.10 more at one place than the other. In the case of the relative humidity of the air he has noted differences of 15 and even 20 hundredths; while in the 2 p.m. and maximum observations as much as from 5 to 6 degrees fahrenheit.

For instance, to show that these thermometric discrepancies, or differences, or disagreements, or errors, or whatever name may be adopted for the nonce, are not due altogether to instrumental errors, whenever the days were very cloudy, or overcast, or hazy, or foggy, the recorded and published temperatures of the Director and the writer were alike—or, at least, within a small fraction—sometimes absolutely the same; but, let the sun shine, and that very brightly, from 2 to 4 p.m., then the Director's maxima temperatures were in excess of the writer's by 2, 3, 4, 5 and even 6 degrees; therefore, in all charity he is forced to the conclusion that the instruments in use at the "Montreal Observatory" are improperly placed, or that the recorded observations are misrepresented. To accept the published records of the Director he cannot; they are in such direct opposition to possibilities that he is compelled to characterize them as either anomalous or incorrect.

The writer trusts that the Director of the "Montreal Observatory" and Professor of Meteorology to McGill College will not view these criticisms upon his thermometric observations as a personal question, and consider it as offensive to doubt them as it is to doubt his word—nothing could be more injurious to science than that such an opinion should be tolerated, even admitting that the character of an observer, as of a woman, if doubted is destroyed. The most unreserved criticism is necessary for truth; and those suspicions respecting his own accuracy, which every observer or philosophical experimenter will entertain, concerning his own observations or researches, ought never to be considered as a reproach when they are kept in view in examining the observations and experiments of others. The minute circumstances and apparently trivial causes which lend their influence towards error, even in persons of the most candid judgment, are among the most curious phenomena of the human mind.

The importance of affording every aid to enable others to try the merits of observations has been so well expressed that the writer will conclude this portion of his strictures on the Professor of Meteorology with an extract from Mayer's preface to his observations:

> " Officii enim cujusque observatoris esse reor, de habitu
> " instrumenti sui, de cura ac precautione, qua usus est, ad
> " illud recte tractandum, deque mediis in errores ejus
> " inquirendi rationem reddere publice, ut aliis quoque
> " copia sit judicandi, quanta fides habenda conclusionibus
> " ex nostris observationibus deductis aut deducendis.
> " Hoc cum minus fecissent precedentis sæculi astronomi,
> " praxin nimis secure, nimisque theoretice tractantes,
> " factum inde potissimum est, ut illorum observationes,
> " tot vigiliis tantoque labore comparatæ tam cito obsol-
> " verint."

In criticising the observations taken at the "Montreal Observatory" and the conduct of those Governors or Professors of McGill College who selected its site, urged and promoted its building, if their sole object was the advancement of Astronomical and Meteorological science they can have no apprehension from the severest scrutiny. The public character of the Governors and Professors of McGill College is legitimate subject for discussion, and their fitness or unfitness may be fairly canvassed. If their sensitiveness makes them shrink from the ordeal they have no right to accept the honours and endowments of office, for they know that this is the condition of all who are either paid from the public purse, or through the charity or liberality of private individuals. The public and those interested in the well-being of McGill College have a right to discuss the merits of its professors, and their manner of executing those duties which they are paid to perform.

The published observations purported to be made by the Director of the "Montreal Observatory" are erroneous, or, at least, not to be relied on in order to get the true isotherm of Montreal. The true direction and force of the wind it is impossible to obtain in consequence of the bad site of the Observatory, even supposing that the self-recording instruments used were of the best construction and on the most approved plan, which they are far from being, as their only commendation is their rudeness; therefore the comparison of a series of observations made at synchronous periods, between those made at the "Montreal Observatory," immediately under one of the steepest ledges of Mount Royal, and those made at the Observatories of Toronto, Quebec and Washington, cannot be, have not been, nor ever will be such as are required to pave the way to the period when Meteorology will acquire the certainty of deduction which it now lacks, and when conjectures relative to future phenomena will become probabilities.

If it is desirable upon the part of the Director of the "Montreal Observatory" and those who raised the money for its erection, and upon the part of the Government which gives an annual grant to the Director, to attain a thorough knowledge of laws as yet unknown that govern the motions of the atmosphere, and what may be called the strange caprices of the weather, and to further the great Meteorological service so happily and wisely inaugurated by the Hon. Minister of Marine and Fisheries, of which the Magnetic Observatory at Toronto is the Dominion centre; and also to aid the still greater international Meteorological service of which the Smithsonian Institution at Washington is the centre, the "Montreal Observatory" must then be placed immediately upon another basis, in order to make the organization of the Meteorological service such as to admit of the pre-announcement of storms, and the adoption of an uniform system of observation. Instruments of a better quality, much as they are needed, will not avail; the Observatory ought to be removed, in fact, if it were demolished it would be a boon to Science (that is, if true Science is a record of facts), unless the building was used, which it now is not, for lectures on the subjects of Meteorology and Astronomy, and as a place where pupils may be taught how to observe, or the art of observing; instructed in the use of instruments of precision, such as the Transit, the Alt-Azimuth instrument, the Sextant, the Repeating and Reflecting Circles, the Theodolite, the Mountain Barometer, &c., in order that the students in the school of Civil Engineering, and in the contemplated school of Mining in connection with the Geological Survey may be satisfied about the limits they can measure the same object, under the same circumstances, as its only from a knowledge of this that they can have confidence in their measures of the same object under different circumstances, and after that, of different objects under different circumstances. Without some such training, and without a considerable training, any astronomical or geodetical observations they may hereafter be called on to make would be of little value. Such training is necessary in order that they may be able to check the "*hoaxing, forging, trimming and cooking frauds*" of some observers, impostors to true Science; and it is further necessary for them to know their own errors in reading and adjusting before they pronounce upon those of the instruments. The instruments now in the Observatory will afford the pupils excellent practice, enabling them to judge of their own skill, and to ascertain the precision with which they can bisect an object with the wires of a telescope, and write down the readings of the verniers of a sextant, and determine its index error.

Such training as the writer has hinted at is absolutely necessary, even though the use of large astronomical instruments does not claim any profound requirements, and the use of ordinary Meteorological instruments does not demand more skill or attention than a school-boy's working out a sum of decimals or vulgar fractions. What chiefly is wanted, is inflexible candour in recording precisely the facts which nature has presented. A man to take charge of a Meteorological Observatory ought to be an indefatigable, hard-working, obedient drudge, (although a drudge of a superior order to a farm labourer), who will be contented to pass half his day in using his hands and his eyes in the mechanical act of observing, and the remainder in the dull process of calculation.

The Principal and Vice-Chancellor, in his pleas for the extension of University education in Canada, begs heartily, and hitherto he has been a very successful beggar, always ready with plausible reasons for additions to McGill College; whether he always begs judiciously is open to grave question. Several thousand dollars expended on an observatory in which the observations made are of little practical value, is not begging with discernment, when a building better adapted for meteorological observations might have been erected for a tenth of the cost of the present one; a building more remote from the influence of the retaining wall of the water-works reservoir; from the trees, whose branches nearly touch the revolving cups of the anemometer, and from the neighbouring houses which cut off the distant meridional mark.

The Principal and Vice-Chancellor has recently set up a plea for a good astronomical telescope, larger and more expensive astronomical instruments, and, in addition, a properly fitted-up observatory and the means of sustaining an observer—a proper observer; but were the instruments obtained, they would be of no use, judging from the service to which the transit instrument has been applied, and of which the public will be better able to judge when the Director of the "Montreal Observatory" has published to the world how he obtained its latitude and longitude, whether they were deduced by the mean of many culminations of Polaris and meridional transits of the moon-culminating stars, and how the fine astronomical clock, by Dent, lent by the Harbour Commissioners,* was rated by transits of *a* Pavonis, and *a* Lyræ, and *a* Vulpeculæ, and *a* Columbæ, and that so accurately that the time ball on the wharf, near the Custom House, was dropped, under the supervision of the Director, within one minute, two minutes, and sometimes three minutes of the mean time,†—perhaps to some not a matter of moment. *Sic transit gloria observationis.* Without wishing to be cynical the writer puts these questions: Was the discrepancy in the ball-dropping to be attributed to that occasional discordance from the mean which attends even the most careful observations? Did the time occupied in causing the extremities of the fingers to obey the volition, as well as the time employed in compressing the flesh before the fingers acted on the stop which released the trigger, which caused the ball to drop, influence the accuracy of the dropping? Was the differences from mean time to be attributed to irregularity of refraction in the atmosphere surrounding McGill College? or to the imperfections in the transit instrument? or to the astronomical clock by Dent? or to the desire for extreme accuracy on the part of the Director?

Such discrepancies demand the *most serious* attention and *early* consideration of those who furnish costly apparatus, laboratories, astronomical instruments, and observatories to colleges, for enabling the student to get the practical study of outward nature, and the laws by which the CREATOR governs the universe.

If an error of three minutes can creep into the rating of a clock by the wrong use of a transit instrument, and in the time of dropping the ball for rating ship-master's chronometers, it may readily be understood, by the dullest apprehension, how a thermometer may be made to read five or six degrees too high in the summer, or five or six degrees too low in the winter; and, how it is that the Director of the "Montreal Observatory" indulges in extremes of temperature, and has succeeded in registering, and recording, and publishing the maxima and minima temperatures reached on the island of Montreal during the past ten years.

If the Director of the "Montreal Observatory" has made some mistakes, and taken observations with insufficient instruments, and those wrongly placed, placed in utter defiance of all instructions sent from Greenwich and Kew, Washington and Toronto, his only course to win the confidence of his fellow-labourers in the cause of Meteorology, and to render his future observations of any use, is to acknowledge the error of his ways in the most full and explicit manner, not concealing and masking oversights and errors. Enough has been written to show that special regard to every circumstance by which the accuracy of the Meteorological observations might be affected, has not been taken, and that usual attention was not bestowed on them by the Director. Had he chosen a proper site for the Observatory and fitted it up with the most approved instruments, he might possibly have derived honours from his labours, and given light to the admiring Science on this continent.

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* Taken away by them from the McGill College Observatory and the Mean Time obtained from the Citadel Observatory, Quebec.

† Giving an error of *only forty-five miles* of longitude.

The writer is glad to know that a Meteorological Society will shortly be formed in Montreal, the members of which will be furnished with the necessary instruments, and guided by proper instructions for their use as regards systematic conformity of observation, so that the society will soon be able to furnish all the data requisite for a complete study of both agricultural and sanitary Meteorology, and that, at no other expense than the tabulation and publication of the observations made by its own members. The society, he trusts, will be able to carry on a well conducted system of co-operative Meteorological observations. He is still more glad to know that a complete set of good instruments will shortly be furnished to the Montreal General Hospital and observations taken with them, so that the surgeons of that institution may not in future depend upon the capricious observations meted out in the daily prints.

That good will result from the Meteorological Society of Montreal, he believes, because it will be the means of bringing personally together those who are interested, if not absolutely engaged, in the same field of science. It will also be the means of an immediate, therefore obvious change of ideas, whether they present themselves as facts, opinions, or doubts. Lastly, he fervently hopes the Society will prove to be the foundation of friendly connexion which will throw light on Meteorological Science, add cheerfulness to life, and give patience and amenity to manners.

MONNREAL, October, 1872.